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Research & Development

NOVEMBER 1984

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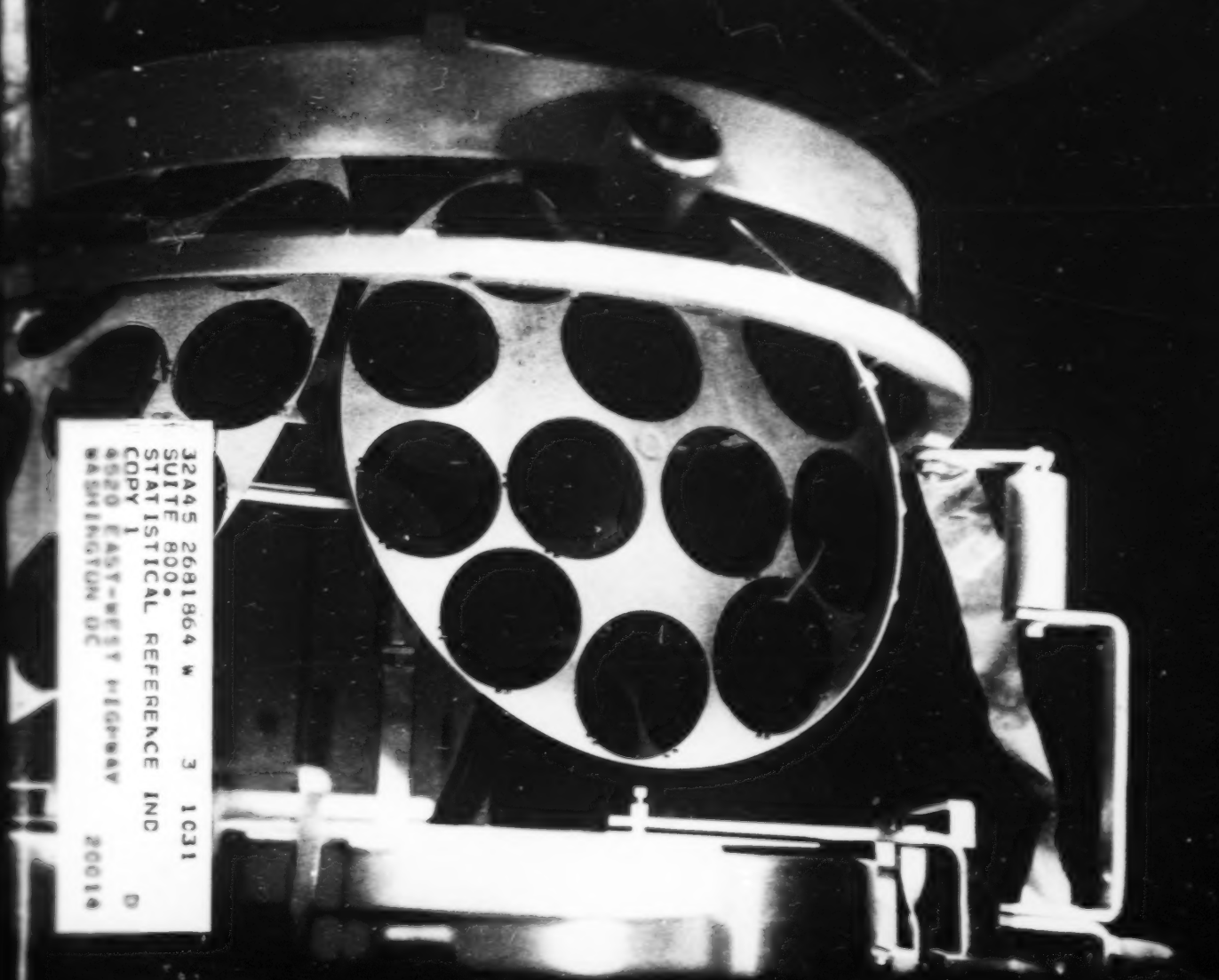

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Vacuum Show issue

Research & Development

SERVING THE $186-BILLION WORLDWIDE R&D INDUSTRY

High-vacuum applications — see pp 123, 130, 138, 146, 152.

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ABOUT THE COVER

Sputter deposition is one of the methods used in the fabrication of modern microcircuitry. General Electric R&D Center, Schenectady, NY, uses this high-vacuum tool to lay down microscopic deposits of metal for conducting pathways that connect thousands of transistors and other circuit elements in a chip with an area less than that of a fingernail.

Manufacture of these complex chips may require more than 100 steps, each depending on highly sophisticated vacuum-processing equipment.

The cover photo was supplied by General Electric R&D Center.

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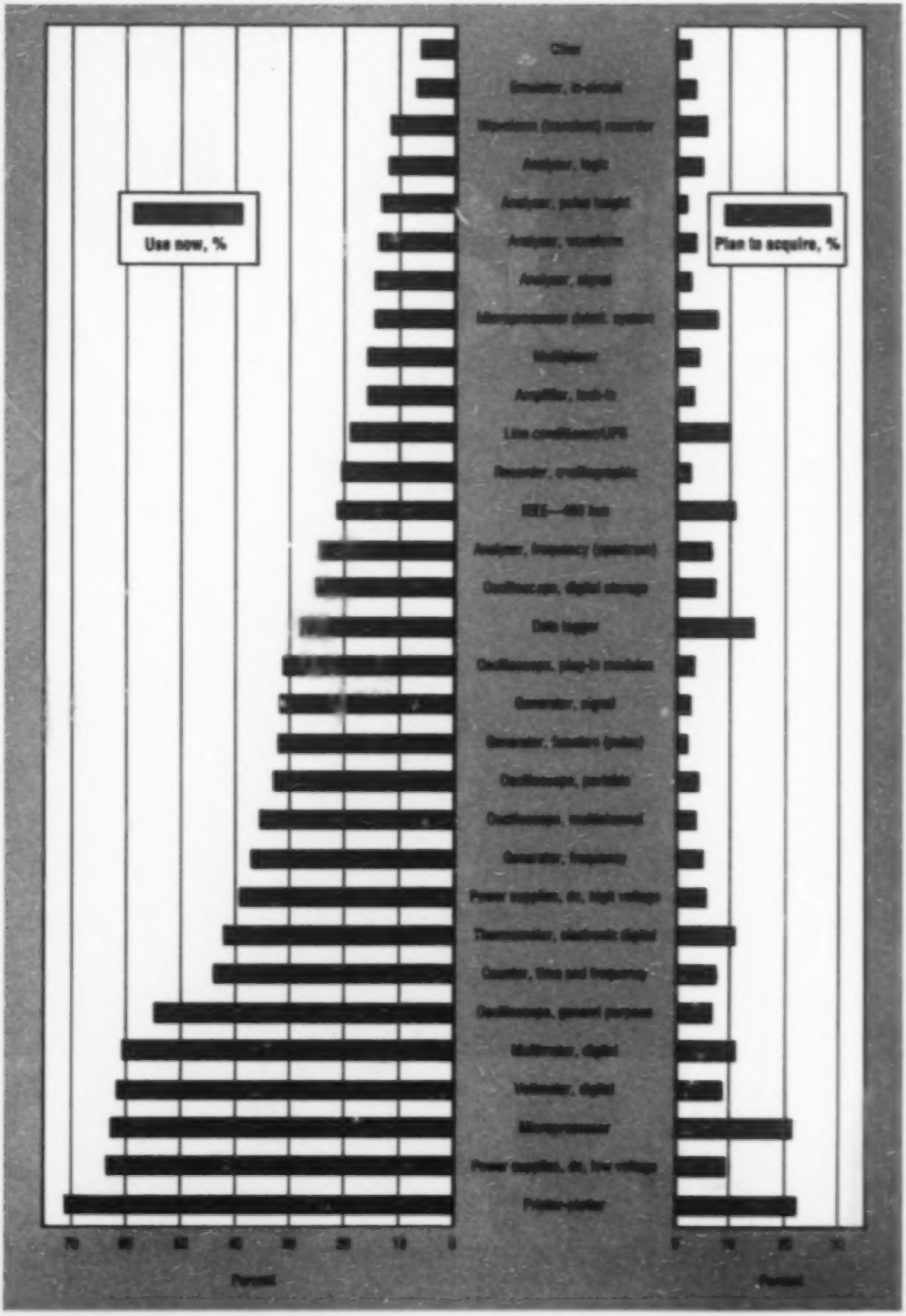

Use now, %
Plan to acquire, %
Other
Emulator, in-circuit
Waveform (transient) recorder
Analyzer, logic
Analyzer, pulse height
Analyzer, waveform
Analyzer, signal
Microprocessor (dvlpt. system)
Multimeter
Amplifier, lock-in
Line conditioner/UPS
Recorder, oscillographic
IEEE—488 bus
Analyzer, frequency (spectrum)
Oscilloscope, digital storage
Data logger
Oscilloscope, plug-in modules
Generator, signal
Generator, function (pulse)
Oscilloscope, portable
Oscilloscope, multichannel
Generator, frequency
Power supplies, dc, high voltage
Thermometer, electronic digital
Counter, time and frequency
Oscilloscope, general purpose
Multimeter, digital
Voltmeter, digital
Microprocessor
Power supplies, dc, low voltage
Printer-plotter
70
60
50
40
30
20
10
0
Percent
0
10
20
30
Percent

C.J. Mosbacher
Executive editor, *R&D*

TRENDSURVEY

Use of electrical and electronic instruments

Plans to acquire new instruments rebound with increases in almost all sectors. Digital instruments lead the way in Trendsurvey.

LAST YEAR'S Trendsurvey indicated a drop of more than 12% in plans to acquire new electrical and electronic instruments within a year of the survey for use in R&D. This year's results are drastically different; plans to acquire have increased dramatically, according to the 898 *Research & Development* readers who replied to the survey. Average present use of 30 categories of instruments was 32.1% compared to 32.2% last year—a drop of 0.3%. Average plans to acquire rose from 6.2% last year to 7.3% now, an increase of 17.7%.

But this does not take into account the fact that respondents this year have different demographic profiles from those to last year's study. For example, this year more engineers, fewer physical scientists, and more life scientists and medical researchers responded.

When these differences, together with differences in employers and job functions are considered and adjusted to state this year's results on the basis of last year's demographics, present use drops to 31.6% and plans to acquire to 7.1%. These "normalized" results show a drop of 1.9% in present use and an increase in plans to acquire of 14.5% over last year.

Another indication of increasing plans to acquire is the more than 12% decrease in respondents having no plans to acquire, from 46.6% to 41.5%. That's even lower than the comparable figure for 1982 — 44.4%.

One possible cause for this present increase in instrument acquisition plans is the increased availability of new digital instrumentation and systems that combine instruments and data processing. The highest ranking in growth rates goes to digital; as do the highest rankings based on plans to acquire, only without consideration of present use.

The top ten categories based on total-sample plans to acquire are: printer-plotters, microprocessors, data loggers, digital multimeters, digital thermometers, IEEE 488 bus, line conditioners-universal power supplies, dc low-voltage power supplies, digital voltmeters, and microprocessor development systems.

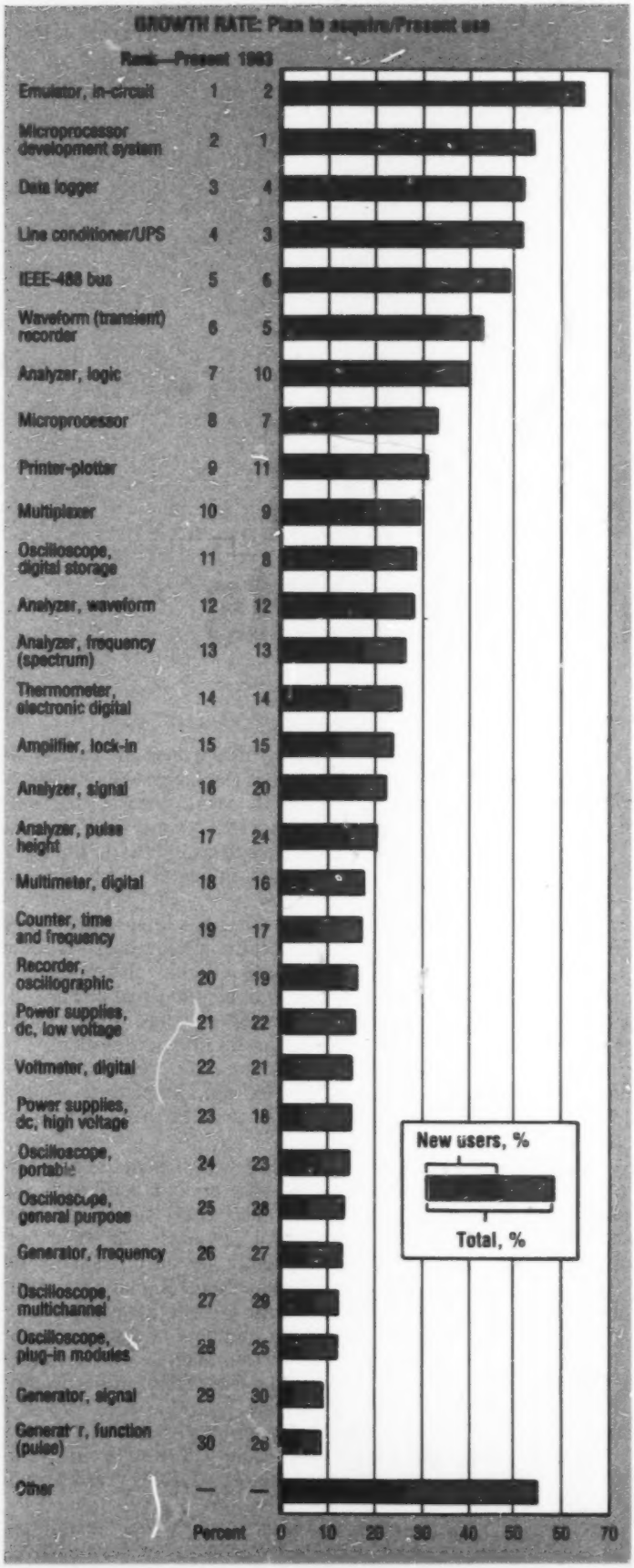
Results of the Trendsurvey are presented graphically on these pages. Present use and plans to acquire are graphed on the facing page as a percent of total respondents.

Growth rates calculated with present use of a particular instrument as the base are summarized in the chart on the next page. This chart shows the total growth rate and the rate for new users—those who indicated they do not presently use an instrument but who plan to acquire it within a year. Rankings this year and last also are given on the growth rate chart.

Complete data giving numbers of respondents as well as percentages for the total sample and disciplines are given in the table on the last page of this article for both growth and growth rate.

Average present use and plans to acquire vary among the demographic groups. The following paragraphs summarize these averages for this year's Trendsurvey and for last year's.

By discipline, and without the "Other" instrument category which is not included in any of the data given


GROWTH RATE: Plan to acquire/Present use
Rank—Present 1983
Emulator, in-circuit 1 2
Microprocessor development system 2 1
Data logger 3 4
Line conditioner/UPS 4 3
IEEE-488 bus 5 6
Waveform (transient) recorder 6 5
Analyzer, logic 7 10
Microprocessor 8 7
Printer-plotter 9 11
Multiplexer 10 9
Oscilloscope, digital storage 11 8
Analyzer, waveform 12 12
Analyzer, frequency (spectrum) 13 13
Thermometer, electronic digital 14 14
Amplifier, lock-in 15 15
Analyzer, signal 16 20
Analyzer, pulse height 17 24
Multimeter, digital 18 16
Counter, time and frequency 19 17
Recorder, oscillographic 20 19
Power supplies, dc, low voltage 21 22
Voltmeter, digital 22 21
Power supplies, dc, high voltage 23 18
Oscilloscope, portable 24 23
Oscilloscope, general purpose 25 28
Generator, frequency 26 27
Oscilloscope, multichannel 27 29
Oscilloscope, plug-in modules 28 25
Generator, signal 29 30
Generator, function (pulse) 30 26
Other — —
New users, %
Total, %
Percent 0 10 20 30 40 50 60 70

in these paragraphs, present use averages 37.7% and plans to acquire average 8.9% for engineering, 30.1% and 6.1% for physical science, and 19.3% and 4.8% for life science and medicine. Comparable data last year were 38.9% and 8.7% for engineering, 28.5% and 5.7% for physical science, and 22.6% and 4.3% life science and medicine.

By employer, industry averages 32.3% present use and 7.4% plans to acquire, universities 35.2% and 7.9%, nonprofit organizations 28.4% and 7.2%, medical research centers 29.9% and 5.3%, and other organizations including government, 29.2% and 6.0%. For last year, comparable data are 30.8% present use and 6.9% plans to acquire for industry, 37.1% and 6.8% for universities, 35.9% and 10.2% for nonprofit organizations, 26.2% and 8.7% for medical research centers, and 31.1% and 6.0% for other organizations including government.

Corporate officers have average present use of 26.1% and average plans to acquire of 13.1%, R&D executives 37.0% and 10.5%, project managers 33.7% and 9.7%, professional staff 32.1% and 5.8%, and others 28.1% and 6.1%. Comparable figures for 1983 were 32.6% and 9.3% for corporate officers, 35.0% and 9.7% for R&D executives, 34.5% and 7.9% for project managers, 31.8% and 6.3% for professional staff, and 28.4% and 6.9% for others.

As noted earlier, the demographics producing these results vary from year to year. In this year's survey, 5.6% are corporate officers, 9.0% R&D executives, 15.9% project managers, 62.9% professional staff, and 5.5% other titles. Last year, the corresponding numbers were 3.0%, 7.0%, 17.1%, 66.3%, and 4.2% respectively. Note that the totals are less than 100% because some respondents did not answer all questions.

By discipline, 47.4% of this year's replies listed engineering, 35.5% physical science, and 14.4% life science or medicine. Comparable figures last year were 43.6%, 40.7%, and 12.2%.

Industry accounted for 53.6% of the replies this year, universities 21.3%, nonprofit organizations 6.1%, medical research centers 3.3%, and others 14.0%. Comparable data last year were 52.6%, 19.6%, 7.4%, 2.6%, and 14.9%.

Geographically, replies correlate well with R&D circulation, with 6.7% New England, 14.5% Middle Atlantic, 18.9% East North Central, 6.5% West North Central, 14.8% South Atlantic, 2.4% East, 5.9% West South Central, 4.3% Mountain, and 17.6% Pacific, with 8.4% not providing a zip code.

As with earlier Trendsurveys, this study was conducted by including a prepaid reply card in a May mailing to *R&D* subscribers in the United States. R&D

PRESENT AND PLANNED USE: Data from 898 respondents	Use now								Plan to acquire within 1 year								Growth rate = plan to acquire ÷ by present use			
	Total, 898		Engineering, 426		Physical science, 319		Life science or medicine, 129		Total, 898		Engineering, 426		Physical science, 319		Life science or medicine, 129		Total	Present users who plan to acquire		New users
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	%	No.	%	%
Amplifier, lock-in 1983	141	15.7 16.9	60	14.1	71	22.3	7	5.4	33	3.7 3.0	14	3.3	16	5.0	2	1.6	23.4	17	12.1	11.3
Analyzer, frequency (spectrum) 1983	220	24.5 24.4	142	33.3	63	19.7	11	8.5	59	6.6 5.5	42	9.9	13	4.1	3	2.3	26.8	21	9.5	17.3
Analyzer, logic 1983	115	12.8 14.6	85	20.0	24	7.5	6	4.7	46	5.1 4.1	31	7.3	11	3.4	4	3.1	40.0	9	7.8	32.2
Analyzer, pulse height 1983	120	13.4 14.6	46	10.8	59	18.5	12	9.3	24	2.7 1.7	11	2.6	10	3.1	2	1.6	20.0	7	5.8	14.2
Analyzer, signal 1983	130	14.5 12.8	78	18.3	38	11.9	10	7.8	28	3.1 1.7	19	4.5	5	1.6	3	2.3	21.5	8	6.2	15.4
Analyzer, waveform 1983	125	13.9 15.0	78	18.3	36	11.3	10	7.8	35	3.9 3.4	26	6.1	7	2.2	2	1.6	28.0	10	8.0	20.0
Counter, time and frequency 1983	402	44.8 46.5	242	56.8	118	37.0	32	24.8	68	7.6 7.1	38	8.9	19	6.0	7	5.4	16.9	40	10.0	7.0
Data logger 1983	258	28.7 26.0	140	32.9	82	25.7	29	22.5	132	14.7 11.8	79	18.5	37	11.6	13	10.1	51.2	39	15.1	36.0
Emulator, in-circuit 1983	56	6.2 4.6	39	9.2	14	4.4	3	2.3	36	4.0 2.3	30	7.0	4	1.3	2	1.6	64.3	3	5.4	58.9
Generator, frequency 1983	339	37.8 39.8	220	51.6	88	27.6	26	20.2	42	4.7 3.6	24	5.6	12	3.8	2	1.6	12.4	24	7.1	5.3
Generator, function (pulse) 1983	287	32.0 32.1	172	40.4	91	28.5	16	12.4	25	2.8 3.4	15	3.5	7	2.2	2	1.6	8.7	13	4.5	4.2
Generator, signal 1983	287	32.0 29.9	181	42.5	83	26.0	16	12.4	27	3.0 2.6	16	3.8	7	2.2	1	0.8	9.4	19	6.6	2.8
IEEE-488 bus 1983	192	21.4 21.5	105	24.6	72	22.6	10	7.8	94	10.5 8.1	46	10.8	36	11.3	7	5.4	49.0	36	18.8	30.2
Line conditioner/UPS 1983	175	19.5 15.4	93	21.8	58	18.2	20	15.5	89	9.9 7.3	52	12.2	28	8.8	7	5.4	50.9	31	17.7	33.1
Microprocessor 1983	570	63.5 63.4	271	63.6	211	66.1	75	58.1	190	21.2 19.8	102	23.9	58	18.2	27	20.9	33.3	130	22.8	10.5
Microprocessor development system 1983	131	14.6 14.1	79	18.5	37	11.6	10	7.8	71	7.9 8.7	47	11.0	17	5.3	4	3.1	54.2	22	16.8	37.4
Multimeter, digital 1983	547	60.9 59.9	298	70.0	193	60.5	45	34.9	97	10.8 10.1	49	11.5	39	12.2	7	5.4	17.7	70	12.8	4.9
Multiplexer 1983	141	15.7 14.2	91	21.4	36	11.3	8	6.2	42	4.7 4.1	23	5.4	11	3.4	6	4.7	29.8	17	12.1	17.7
Oscilloscope, digital storage 1983	223	24.8 22.7	144	33.8	63	19.7	12	9.3	63	7.0 7.0	45	10.6	13	4.1	4	3.1	28.3	20	9.0	19.3
Oscilloscope, general purpose 1983	492	54.8 58.5	274	64.3	173	54.2	41	31.8	63	7.0 5.1	35	8.2	20	6.3	7	5.4	12.8	36	7.3	5.5
Oscilloscope, multichannel 1983	321	35.7 38.9	200	46.9	91	28.5	23	17.8	38	4.2 3.3	27	6.3	9	2.8	1	0.8	11.8	17	5.3	6.5
Oscilloscope, plug-in modules 1983	278	31.0 30.9	167	39.2	90	28.2	18	14.0	32	3.6 3.4	22	5.2	7	2.2	2	1.6	11.5	21	7.6	4.0
Oscilloscope, portable 1983	304	33.9 34.8	184	43.2	92	28.8	20	15.5	41	4.6 4.2	29	6.8	9	2.8	2	1.6	13.5	15	4.9	8.6
Power supplies, dc, high voltage 1983	355	39.5 38.4	160	37.6	145	45.5	36	27.9	49	5.5 5.7	25	5.9	19	6.0	2	1.6	13.8	35	9.9	3.9
Power supplies, dc, low voltage 1983	573	63.8 63.3	307	72.1	198	62.1	55	42.6	88	9.8 8.2	49	11.5	31	9.7	6	4.7	15.4	68	11.9	3.5
Printer-plotter 1983	635	70.7 69.7	291	68.3	245	76.8	87	67.4	191	21.3 16.1	95	22.3	60	18.8	32	24.8	30.1	113	17.8	12.3
Recorder, oscillographic 1983	181	20.2 23.3	101	23.7	55	17.2	22	17.1	30	3.3 3.1	21	4.9	5	1.6	4	3.1	16.6	8	4.4	12.2
Thermometer, electronic digital 1983	379	42.2 45.0	204	47.9	133	41.7	32	24.8	96	10.7 9.6	50	11.7	29	9.1	12	9.3	25.3	45	11.9	13.5
Voltmeter, digital 1983	553	61.6 62.5	308	72.3	186	58.3	47	36.4	83	9.2 8.2	40	9.4	31	9.7	9	7.0	15.0	62	11.2	3.8
Waveform (transient) recorder 1983	111	12.4 12.0	63	14.8	38	11.9	7	5.4	48	5.3 4.7	31	7.3	13	4.1	3	2.3	43.2	10	9.0	34.2
Other 1983	51	5.7 6.1	26	6.1	16	5.0	7	5.4	28	3.1 3.3	15	3.5	9	2.8	4	3.1	54.9	15	29.4	25.5

OPINION POLL RESULTS

Republicans, political activism get vote in survey of readers

THE REPUBLICAN party has been the more responsive of the two major parties in the U.S. to the interests and needs of R&D. This is the conclusion to be drawn if our survey of nearly 1,800 readers is representative of the industry. Understandably, the respondents who rated Republicans as most responsive in the past expect that they would do better than the Democrats in the future.

In both instances, however, there was a large number (33% and 24%) rating the parties about equal.

Eighty-eight percent of the respondents believe that scientists and engineers should be involved, either as groups or as individuals, in politics as it affects R&D.

The complete results or our survey follow.

1. *Which major party has been the most responsive to R&D interests and needs?*
   a. Republican ... 41% c. About equal 33%
   b. Democrat 26

2. *Which of the major parties is most likely, in the next four years, to be responsive to R&D interests and needs?*
   a. Democrat ..... 28% c. About equal 24%
   b. Republican ... 48

3. *Political candidates often make promises in the heat of campaigning and then forget them. Which party has the best record for keeping its promises to R&D?*
   a. Republican ... 36% c. About equal 46%
   b. Democrat 18

4. *Do you think that scientists and engineers should be involved, either in groups or as individuals, in politics in general?*
   a. Yes ... 81% b. No ... 13% c. No opinion 6%

5. *Do you think that scientists and engineers should be involved, either in groups or as individuals, in politics as it affects R&D?*
   a. Yes ... 88% b. No .... 7% c. No opinion 4%

6. *Should well-known scientists and engineers identify with specific efforts to influence political decisions (including elections) favorably for R&D?*
   a. Yes ... 69% b. No ... 21% c. No opinion ... 10%

7. *Should scientists and engineers in general organize in order to bring pressure in support of candidates and ideas favorable to R&D?*
   a. Yes ... 64% b. No ... 26% c. No opinion ... 10%

8. *Do you consider yourself to be politically ...*
   a. Conservative 29% c. Middle of the road 23%
   b. Liberal ..... 14 d. Depends on the subject 34

9. *When it comes to elections, do you vote a "straight ticket" ...*
   a. Always ..... 2% d. Never 43%
   b. Usually ..... 20 e. Only to match President and Congress 2
   c. Not often 33

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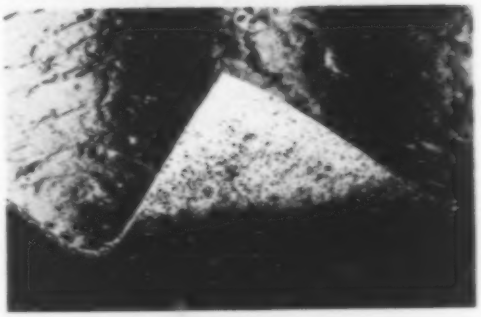

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